

SHOWN WITHOUT GRILLE

MTL-2BT Manifold Technology® Low-Frequency Sound Reinforcement System

- EVX-180A woofers for explosive-impact, reliable bass
- Smaller MT trapezoidal enclosure
- High acoustic output, low distortion
- Manifold Technology® enables smaller and lighter loudspeaker arrays
- MT systems with different coverage patterns and output capabilities may be mixed and matched
- Unique rigging scheme for flexible array design and quick assembly
- Available without rigging hardware

SPECIFICATIONS

Frequency Response (measured in farfield, calculated to one meter on axis, swept sine wave, one watt input into LF midband, anechoic environment; see Figure 1):

37-200 Hz

Low-Frequency 3-dB-Down Point:

45 Hz

Usable Low-Frequency Limit (10-dB-down point):

35 Hz

Half-Space Reference Efficiency:

6.0%

Long-Term Average Power-Handling Capacity (per ANSI/EIA 426-A 1980; see Power Handling Section):

1,200 watts

Maximum Long-Term Average Midband Acoustic Output:

72 watts

Sensitivity (SPL at one meter, indicated input power, anechoic environment, band-limited pink-noise signal):

1 Watt: 99.5 dB

1,200 Watts: 130.5 dB

Beamwidth (angle included by 6-dB-down points on polar responses, indicated one-third-octave bands of pink noise; see Figures 3 and 4):

80- to 160-Hz Horizontal:

260° (+80°, -50°)

80- to 160-Hz Vertical:

225° (+85°, -35°)

Directivity Factor $R_s(Q)$, 63- to 100-Hz Median (see Figure 5):

2.17 (+0.19, -0.33)

Directivity Index D_s , 80- to 160-Hz Median (see Figure 5):

3.36 dB (+0.37 dB, -0.71 dB)

Distortion, 0.1 Full Power Input (see Figure 6),

Second Harmonic,

50 Hz: 2.0%

100 Hz: 1.3%

Third Harmonic,

50 Hz: 1.2%

100 Hz: <0.1%

Transducer Complement,

Two EVX-180A

Box Tuning Frequency:

37 Hz

Impedance (LF1 and LF2, paralleled; see Figures 2 & 7),

Nominal:

4 ohms

Minimum:

3.6 ohms

Input Connections:

Neutrik Speakon® NL4MPR

Enclosure Materials:

14-ply birch plywood

Finish:

Black carpet

Hanging:

Two-point flying system (tracks accept Kinedyne 32102-1 and 32111-1 fittings)

Dimensions,

Height: 91.4 cm (36.00 in.)

Width at Front: 57.2 cm (22.50 in.)

Width at Back: 28.3 cm (11.13 in.)

Depth: 75.9 cm (29.88 in.)

Side Angles: 15° each (30° wedge)

Net Weight:

69.9 kg (154 lb)

Shipping Weight:

74.8 kg (165 lb)

DESCRIPTION

The Electro-Voice MTL-2BT low-frequency loudspeaker system is a member of the family of Manifold Technology® MT loudspeaker systems designed for high-level sound reinforce-

ment in concert-sound touring and permanent-installation applications. The MTL-2BT is a manifolded vented-box low-frequency system with a trapezoidal enclosure, utilizing two very-high-power 18-inch woofers. This configuration results in remarkably high acoustic output from a small enclosure. The MTL-2BT may be combined with other members of the MT-2B and MT-4B loudspeaker family. The combination of the MTL-2BT loudspeaker system and the MTH-2B midbass/mid-frequency/high-frequency loudspeaker systems form the MT-2B full-range system. There are two models in the MTL-2BT series: the MTL-2BTFC (carpeted finish with flying hardware) and the MTL-2BTC (carpeted finish without flying hardware).

The MTL-2BT is a vented-box design comprised of two EVX-180A 18-inch woofers, each facing into a manifold chamber at the center of the enclosure. This manifolding technique (U.S. Patent No. 4,733,749) results in increased acoustic loading, yielding increased low-frequency efficiency and reduced distortion over conventional direct-radiating designs in a remarkably small enclosure. The MTL-2BT is typically 2-3 dB more efficient than horn-loaded enclosures of equivalent size in the 40-80 Hz range. Additionally, by having the motor structure on the outside of the enclosure, this radical design allows for efficient heat transfer from the loudspeakers to minimize thermal build up during extended periods of high-power operation.

The EVX-180A was designed to deliver the highest possible low-frequency output, and is ideal for manifolding in the MTL-2BT enclosure. Its extended 4-inch-diameter voice-coil design assures linear, low-distortion output at extremely high-power levels, while its robust mechanical design is capable of withstanding the high acoustic pressures developed in the manifold chamber during explosive instantaneous power peaks.

MTL-2BT SPECIFICATION GRAPHICS

FIGURE 1 — Axial Frequency Response

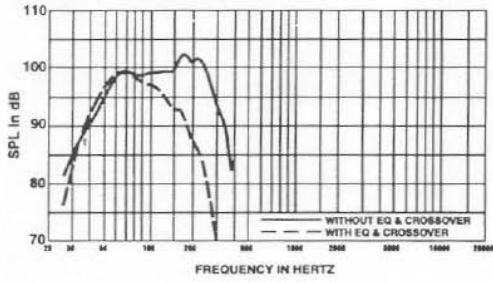


FIGURE 2 — Impedance vs. Frequency

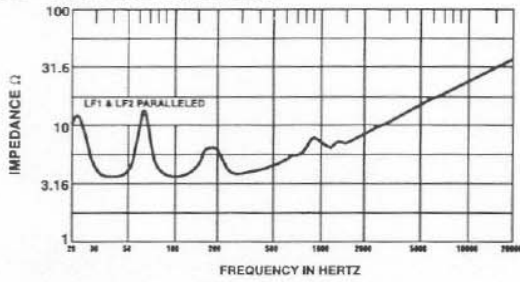


FIGURE 3 — Polar Response

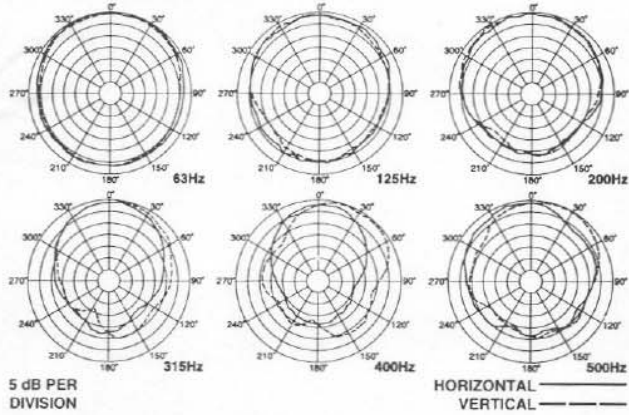


FIGURE 4 — Beamwidth vs. Frequency

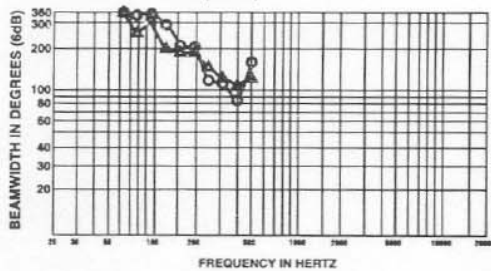


FIGURE 5 — Directivity vs. Frequency

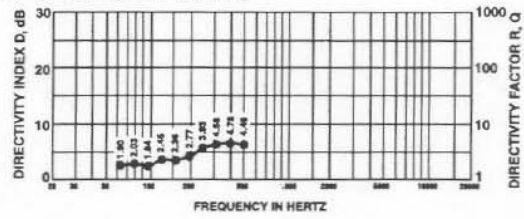


FIGURE 6 — Harmonic Distortion

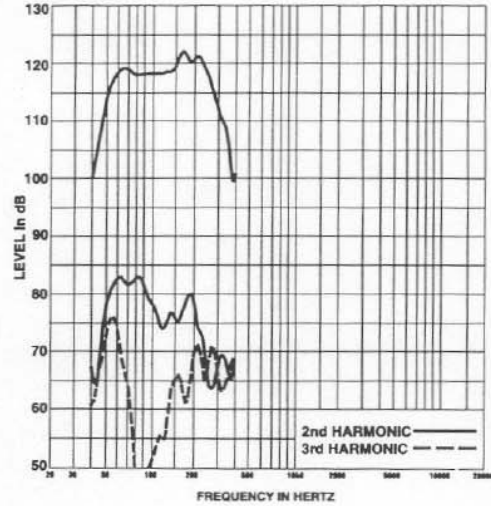
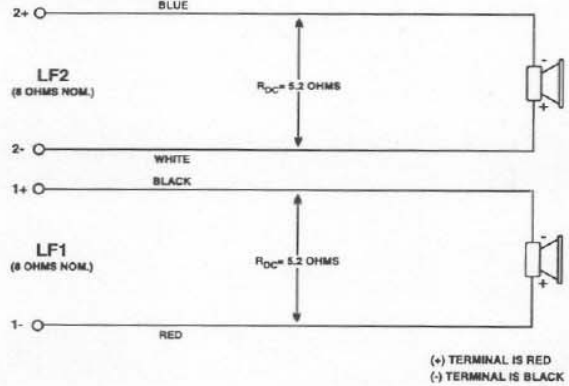


FIGURE 7 — Wiring Diagram



All versions of the MTL-2BT are constructed of 0.75-inch-thick, 14-ply birch plywood and extremely well braced to survive the rigors of the road. The MTL-2BTCF (flying) and MTL-2BTC (non-flying) systems are covered with black Ozite Super TNT carpeting, the most rugged in the industry. The MTL-2BTCF system incorporates a unique two-point flying system. All models feature a black nylon cloth grille.

APPLICATIONS

The MTL-2BT is ideal for any professional concert-sound touring or permanent-installation application requiring high sound pressure levels at low frequencies with low distortion from a compact enclosure. The Manifold Technology® design maximizes the acoustic output per enclosure frontal area, acoustic output per enclosure bulk volume, and acoustic output per enclosure weight of the loudspeaker system. This enables loudspeaker arrays to be constructed that are significantly smaller and lighter than would be obtainable with conventional loudspeaker-system designs. The MTL-2BT may be combined with other members of the MT-2B and MT-4B loudspeaker family, providing the array designer a variety of coverage angles, acoustic output and enclosure sizes from which to choose. For full-range applications, the MTL-2BT may be combined with the MTH-2B or MTH-4B midbass/mid-frequency/high-frequency loudspeaker systems. (The MTH-2/64BT system has a trapezoidal enclosure that is dimensionally identical to the MTL-2BT.) For maximum acoustic performance of the MT loudspeaker systems, the Electro-Voice Dx34 digital electronic crossover/equalization/time-delay/limiter unit is recommended.

Careful attention was paid to details to provide both the touring company and sound contractor a convenient and timesaving sound reinforcement package. The MT-2B dimensions were chosen for efficient truck pack and high-density array design. The systems may be stacked four high and three wide (or three high and four wide) in a standard truck box, enabling 12,000 watts of sound system to be accommodated in only three feet of truck-floor length. The two-point rigging system offers flexible array design and efficient assembly. To facilitate service, a variety of screws, washers and hex key wrenches are provided with each loudspeaker system. In addition, there are wiring diagram labels in convenient locations inside the enclosure.

FREQUENCY RESPONSE

The MTL-2BT frequency response (shown in Figure 1) was measured, both with and without equalization and crossover filters, on axis in the farfield in an anechoic environment using a swept sine-wave signal. When measured with an electronics, the Dx34 digital electronic unit was used to provide the necessary crossover filters and equalization. With the crossover in place, a high-pass protection filter was applied to the low end of the low-frequency section. One watt of power (2.00 volts rms at 70 Hz) was applied to the midband of the low-frequency section. The sound pressure level was normalized for an equivalent one-meter distance.

DIRECTIVITY

The directional response of the MTL-2BT was measured in an anechoic environment at a distance of 6.1 meters (20 feet) using 1/3-octave-filtered pink noise. A full spherical mea-

surement system was used. The polar response of the loudspeaker system at selected 1/3-octave frequencies is shown in Figure 3. The frequencies selected are fully representative of the polar response of the system. The beamwidth of the system utilizing the complete 1/3-octave polar data is shown in Figure 4. The Directivity Factor (Q), R_{θ} , and Directivity Index, D_{11} , are shown in Figure 5. Complete AcoustaCADD™ data is available for the MTL-2BT loudspeaker system.

DISTORTION

Distortion for the MTL-2BT (shown in Figure 6) was measured on axis in the farfield in an anechoic environment at a level of 0.1 times the full-power rating (120 watts), as per the AES standard. The sound pressure level was normalized for an equivalent one-meter distance. Plots of second- and third-harmonic distortion are shown referenced to the fundamental.

POWER-HANDLING CAPACITY

Electro-Voice components and systems are manufactured to exacting standards to ensure reliability in continuous use in arduous real-life conditions. Besides utilizing industry-standard power tests, extreme in-house power tests which push the performance boundaries of the loudspeakers are also performed for an extra measure of reliability. The MT systems are rated as per the ANSI/EIA 426-A Loudspeaker Power Rating, Full Range Test, which uses a shaped-random-noise signal to simulate typical music to test the mechanical and thermal capabilities of the loudspeakers. Specifically, the MTL-4B passes the ANSI/EIA 426-A power test with the following test parameters:

LF Section (LF1 & LF2 paralleled):

P_{EIMAX} :	1,200 watts total
Test Voltages:	58.7 volts rms
	117.4 volts peak
R_{SR} (1.15 x R_E):	2.88 ohms each input

SUBPASSBAND SPEAKER PROTECTION

Below the enclosure tuning frequency, cone excursion increases rapidly with little increase in acoustic output. It is, therefore, highly recommended that a high-pass filter be used to protect the system against subpassband signals. A high-pass filter 3 dB down at 32 Hz with a minimum slope of 12 dB per octave is sufficient to provide adequate protection for the MTL-2BT. Without protection, subpassband signals may "bottom" the woofers (i.e., cause the voice coils to strike the back plate), which can result in damage to the speakers. Even if bottoming does not occur, the subpassband signals waste amplifier power, cause undue mechanical stress on the speakers, and result in high levels of loudspeaker distortion.

USE IN MULTIPLES

MTL-2BT systems may be used in multiples to increase acoustic output. When two loudspeaker systems are placed side by side, a 6-dB increase in maximum acoustic output power is possible at low frequencies (assuming all woofers are operating with the same polarity). This increase occurs because, at low frequencies, the woofer cones from the two systems mutually couple, acting as a single cone with twice the area and, therefore, twice the efficiency, providing a 3-dB increase in sound pressure level. The second 3-dB comes from the doubling of the power capacity by adding a second system. Mutual coupling occurs when the cen-

ter-to-center spacing between the two loudspeaker systems is approximately one-half wavelength or less. When the spacing is greater than one-half wavelength (as would occur if two systems were widely spaced) the maximum acoustic power output increase is limited to the 3-dB power-handling increase.

Additional sound pressure level can also occur from the increased directivity that results when multiple systems are closely arrayed together. If two systems are placed side by side, the beamwidth of the combined systems at low-frequencies will be approximately one half the beamwidth of a single system in the plane that they are arrayed. Adding additional systems will reduce the beamwidth further at low frequencies. Systems can be arrayed both horizontally and vertically to increase directionality in both planes.

LOUDSPEAKER LOCATION

Low-frequency loudspeaker systems, such as the MTL-2BT, are often located on the floor (or close to walls). This is often convenient and provides additional acoustic loading to increase the low-frequency efficiency of the system. Because there is typically little directional information present in program material below 125 Hz, the audible location of the low-frequency loudspeaker systems will not be particularly evident with those systems located on the floor, separated from the higher-frequency systems positioned overhead for the desired locational cues and uniform audience coverage.

Other situations, however, may benefit from having the low-frequency systems suspended overhead along with the higher-frequency systems. Floor space may be limited, or sightlines may be a problem on the main-floor seating area, requiring low-frequency systems to be suspended overhead; higher crossover frequencies or program material with low-frequency locational cues may require may require the low-frequency systems to be located near the higher-frequency systems; or a particular geometric layout of a venue and sound system may require low-frequency systems to be suspended overhead for even coverage. In these instances, it may be possible to regain much of the efficiency lost by removing the low-frequency systems from the floor, by closely spacing the systems to increase the mutual coupling, and by constructing the low-frequency array in a manner that increases the low-frequency directivity.

CROSSOVER, EQ AND TIME DELAY

The usable frequency range of the MTL-2BT low-frequency loudspeaker system is 32-200 Hz. A crossover frequency of 160 Hz with 24-dB-per-octave slopes is recommended. For full-range applications, one of the MTH-2B midbass/mid-frequency/high-frequency loudspeaker systems is recommended for use with the MTL-2BT. For optimal acoustic performance, the Electro-Voice Dx34 digital electronic crossover/equalization/time-delay unit is recommended.

The Dx34 is a programmable, two-in/four-out, digital electronic unit which may be configured for stereo two-way, mono three-way plus subwoofer, or mono four-way operation. Each output section includes crossover filters, equalization, limiting, time delay, polarity and gain adjustment; the parameters of which all may be

programmed and stored by the user. In the mono, four-way configuration, the Dx34 includes factory presets for optimal performance of the MT-2/64B loudspeaker system (the MTL-2BT and MTH-2/64BT systems combined) and the MT-2/94B loudspeaker system (the MTL-2BT and MTH-2/94B systems combined) that utilize Linkwitz-Riley 24-dB-per-octave crossover filters at 160 and 1,600 Hz. Each output section has equalization specifically matched to the loudspeaker system, and time delay set to achieve zero lobing error and time alignment between frequency bands. In addition, the output levels of each frequency band are set so that, with the output level controls set in the zero dB position, the loudspeaker system will have a flat frequency response in an anechoic environment when used with amplifiers having identical gain.

ELECTRICAL CONNECTION AND SYSTEM WIRING

Electrical connections to the MTL-2BT are made on the back of the enclosure via a 4-pin connector. There are two connectors on the input panel to allow paralleling of other MTL-2BT systems. The Neutrik Speakon® NL4MPR is used for both connections. One mating Neutrik Speakon® NL4FC cable-end connector is supplied with each loudspeaker system. The pin assignments are as follows:

Pin 1+: LF1 (+)	Pin 1-: LF1 (-)
Pin 2+: LF2 (+)	Pin 2-: LF2 (-)

The MTL-2BT has two 8-ohm woofers, with one connected to Pins 1+/1- and the other to Pins 2+/2-. A wiring diagram of the loudspeaker system is shown in Figure 7. The electrical impedance versus frequency is shown in Figure 2.

FLYING THE MT SYSTEMS

A manual entitled the *MT Flying Manual* is available from Electro-Voice, and is included with each flying MT loudspeaker system. A brief introductory overview is included here. The *MT Flying Manual* should be consulted for complete structural specifications and detailed information on safely suspending and using the MT systems.

The MTL-2BT (carpeted) is the version of the MTL-2BT loudspeaker system that includes flying hardware. The MT systems incorporate a unique two-point flying system that permits a wide range of vertical angle adjustment, and offers maximum flexibility in array design and implementation for both touring sound and permanent installations. The quick-release, aircraft L-track-type, hardware design allows arrays of loudspeakers to be assembled (and disassembled) very quickly, and offers such flexibility in the vertical angling of cabinets that pull-up points are usually unnecessary. Furthermore, all of the flying MT-2B and MT-4B loudspeaker models include the same rigging hardware, allowing the different models to be mixed as necessary throughout an array.

The rigging track accepts Kinedyne 32102-1 and 32111-1 type double-stud ring fittings. Individual rigging points have typical break-strength ratings of 3,750-4,000 pounds; which

translates to working-load ratings of 750-800 pounds for a 5:1 safety factor. (Consult the *MT Flying Manual* for specific structural strength ratings and limitations.) The enclosures may be oriented with the rigging track on the sides of the enclosure, or on the top and bottom, and may be daisy chained together as long as the safety factor is 5:1 or greater, and local regulations are met. Electro-Voice offers a line of flying-hardware accessories for use with the MT loudspeaker systems.

CAUTION: The MT loudspeaker systems should be suspended overhead only in accordance with the procedures and limitations specified in the *MT Flying Manual* and manual update notices.

FIELD SERVICE

In the unlikely event that the MTL-2B should require service, the 18-inch woofers can be accessed from the front of the enclosure by removing the grille using a #2 Phillips screwdriver. The woofers can be unbolted using a 5/32-inch hex-key wrench, and slid straight out of the manifold chamber. There is a wiring diagram label for the system located on the underside of the input panel. As a further service convenience, a hardware kit that includes a 5/32-inch hex key and an assortment of spare screws and washers are included with every MTL-4B loudspeaker system.

A woofer failure will require the entire driver to be returned to an authorized Electro-Voice service center for repair. The following parts are available from the Electro-Voice Service Department in Buchanan, Michigan:

MTL-2BT Service Data Sheet: #534488
LF: #818-2389 EVX-180A Complete Driver

ARCHITECTS' AND ENGINEER'S SPECIFICATIONS

The loudspeaker system shall be a low-frequency system, and shall operate from 37-200 Hz with a sensitivity of 99.5 dB for one watt at one meter. The system shall consist of two 18-inch woofers manifolded at the center of a vented-box enclosure, have a total input impedance of 4 ohms, and have a power rating of 1,200 watts as per ANSI/EIA 426-A. The loudspeaker system shall have a trapezoidal enclosure with 15 angled sides forming a 30 degree wedge, shall be constructed from 0.75-inch thick, 14-ply birch plywood, shall be finished with a black carpet, shall have a black nylon grille, and shall have a two-point rigging system that will accept Kinedyne 32102-1 or 32111-1 type double-stud ring fittings (if applicable). The loudspeaker enclosure shall be 36.00 inches high, 22.50 inches wide at the front, 11.13 inches wide at the back and 29.88 inches deep, and shall weigh 154 pounds. The loudspeaker system shall be the Electro-Voice MTL-2BT (MTL-2BT or MTL-2BTC).

UNIFORM LIMITED WARRANTY

Electro-Voice products are guaranteed against malfunction due to defects in materials or workmanship for a specified period, as noted in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual, beginning with the date of original

purchase. If such malfunction occurs during the specified period, the product will be repaired or replaced (at our option) without charge. The product will be returned to the customer prepaid. **Exclusions and Limitations:** The Limited Warranty does not apply to: (a) exterior finish or appearance; (b) certain specific items described in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual; (c) malfunction resulting from use or operation of the product other than as specified in the product data sheet or owner's manual; (d) malfunction resulting from misuse or abuse of the product; or (e) malfunction occurring at any time after repairs have been made to the product by anyone other than Electro-Voice or any of its authorized service representatives. **Obtaining Warranty Service:** To obtain warranty service, a customer must deliver the product, prepaid, to Electro-Voice or any of its authorized service representatives together with proof of purchase of the product in the form of a bill of sale or receipted invoice. A list of authorized service representatives is available from Electro-Voice at 600 Cecil Street, Buchanan, MI 49107 (616/695-6831 or 800/234-6831). **Incidental and Consequential Damages Excluded:** Product repair or replacement and return to the customer are the only remedies provided to the customer. Electro-Voice shall not be liable for any incidental or consequential damages including, without limitation, injury to persons or property or loss of use. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **Other Rights:** This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Electro-Voice Speakers and Speaker Systems are guaranteed against malfunction due to defects in materials or workmanship for a period of five (5) years from the date of original purchase. The Limited Warranty does not apply to burned voice coils or malfunctions such as cone and/or coil damage resulting from improperly designed enclosures. Electro-Voice active electronics associated with the speaker systems are guaranteed for three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

Electro-Voice Flying Hardware (including enclosure-mounted hardware and rigging accessories) is guaranteed against malfunction due to defects in materials or workmanship for a period of one (1) year from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

Electro-Voice Accessories are guaranteed against malfunction due to defects in materials or workmanship for a period of one (1) year from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

Service and repair address for this product: Electro-Voice, Inc., 600 Cecil Street, Buchanan, Michigan 49107 (616/695-6831 or 800/234-6831).

Specifications subject to change without notice.



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